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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/743,240	12/22/2003	Grant Hay	122055-4	6975

7590 07/05/2005

General Electric Company
CRD Patent Docket Rm 4A59
Bldg. K1
P.O. Box 8
Schenectady, NY 12301

EXAMINER	
HON, SOW FUN	

ART UNIT	PAPER NUMBER
1772	

DATE MAILED: 07/05/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

RECEIVED OIPE/IAP JUL 12 2005

CANCELLED

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PTO-90C (Rev. 10/03)

Office Action Summary	Application No. 10/743,240	Applicant(s) HAY ET AL.	
	Examiner Sow-Fun Hon	Art Unit 1772	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 15-27 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 15-27 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 22 December 2003 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 12/22/03.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 15-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ito et al. (US 6,476,179) in view of Mitsubishi Chem Corp (Derwent 2002-409329).

Regarding claims 15, 20-21, Ito has a polycarbonate with transparency and dimensional stability used for optical devices (appliances) such as optical discs (column 4, lines 50-60). The polycarbonate comprises a bis(4-hydroxyphenyl)alkane (column 4, lines 50-60), one of which is bis(4-hydroxyphenyl)menthane (column 4, lines 35-45). 1,3-bis (4-hydroxyphenyl)menthane is the monomer which when polymerized yields the repeat unit of formula (I) in claim 1 (in Applicant's disclosure, page 14, Example 1). Ito gives 1,8-bis(4-hydroxyphenyl) menthane as an example of the bis(4-hydroxyphenyl) menthanes used in the polycarbonate (column 4, lines 35-45). 1,3-bis(4-hydroxyphenyl)menthane and 1,8-bis(4-hydroxyphenyl)menthane are chemical isomers because the two hydroxylphenyl substituents are at different positions on the menthane ring. The similarity in chemical structure and function entails the motivation of one skilled in the art to make a claimed compound, in the expectation that compounds

similar in structure will have similar properties. See MPEP 2144.09. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made, to have used 1,3-bis(4-hydroxyphenyl)menthane in place of the 1,8-bis(4-hydroxyphenyl)menthane of Ito, in order to obtain the desired polycarbonate substrate properties.

Ito teaches a method for using a polycarbonate in an optical disc (column 1, lines 15-25). Ito fails to disclose the use of the polycarbonate comprising disposing a substrate made from the polycarbonate in an optical display device or a light-emitting device.

Mitsubishi Chem Corp teaches that a plastic substrate (sheet) with good dimensional stability (advantage section) is useful for an optical disc, an organic electric luminescent display panel (light-emitting device as defined by Applicant in claim 7) and a liquid crystal display panel (which is an optical display device as defined by Applicant is claim 6) (use section). Mitsubishi Chem Corp thus demonstrates the equivalency of an optical disc with a liquid crystal display device and an organic electroluminescent device as an optical device in which disposing a plastic substrate with good dimensional stability is useful.

Therefore, because Mitsubishi Chem Corp teaches that it is useful to dispose a plastic substrate with good dimensional stability in liquid crystal display (an optical display device as defined in claim 20) and an organic electroluminescent device (a light-emitting device as defined in claim 21) as well as an optical disk, and Ito teaches that the polycarbonate has good transparency and dimensional stability suitable for use in

optical devices such as an optical disc, it would have been obvious to one of ordinary skill in the art at the time the invention was made, to have used the polycarbonate comprising the chemical isomers of formula (I) of Applicant as taught by Ito, in a method for using a polymeric substrate comprising disposing said polymeric substrate in an optical display device or a light emitting device, as well as an optical disc, in order to obtain an optical device with the desired transparency and dimensional stability.

Regarding claim 16, in the bis(4-hydroxyphenyl)menthanes, R^7 and R^8 are hydrogen, m is 4 and q is 4 (there are 4 hydrogens on each of the two phenyl rings since each ring is only substituted at the 1 and 4 para positions).

Regarding claims 17-19, Ito teaches heat resistance, dimensional stability and transparency as properties of polycarbonate (column 1, lines 15-25). A chemical composition and its properties are inseparable. Therefore, if the prior art teaches the chemical structure, the properties applicant discloses and/or claims are necessarily present. See MPEP 2112.01. The 1,3-bis(4-hydroxyphenyl)menthane polycarbonate is thus expected to have a glass transition temperature of greater than about 235 °C (claim 17), uniform thickness that varies less than about 3 % (claim 19), and haze less than about 4 % (claim 18).

3. Claims 22-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ito in view of Mitsubishi Chem Corp, as applied to claims 15-21 above, and further in view of Hoshikawa (US 4,640,583).

Ito in view of Mitsubishi has been discussed above, and teaches a polycarbonate which comprises chemical isomers of formula (I) of Applicant wherein R^7 and R^8 are

hydrogen, m is 4 and q is 4, wherein the polycarbonate substrate is disposed in a liquid crystal display device, but fails to teach that the polycarbonate substrate further comprises at lest one barrier layer.

Hoshikawa teaches that the barrier layer 5 laminated on the substrates 10, 11, prevents moisture or air from invading the display medium (column 11, lines 35-45), and can be organic or inorganic (column 11, lines 60-65). The display medium can be liquid crystal or electroluminescent (column 16, lines 30-35). The substrate can be polycarbonate (column 4, line 55).

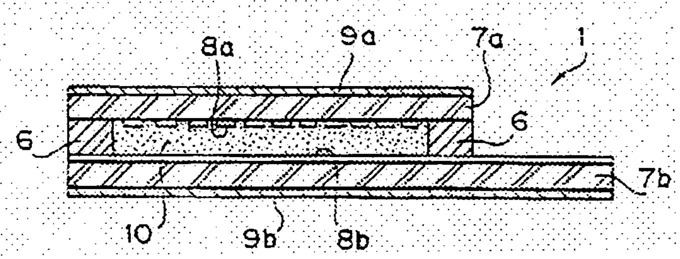
Therefore it would have been obvious to one of ordinary skill in the art to have disposed a barrier layer on the polycarbonate substrate of Ito in view of Mitsubishi, as an additional step to a method of disposing a polymeric substrate in an optical device, in order to obtain an optical display device or a light emitting device wherein the display medium is protected from moisture or air.

4. Claims 24-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ito et al. in view of Mitsubishi Chem Corp as applied to claims 15-21 above, and further in view of Imazeki et al. (US 5,847,782).

Ito in view of Mitsubishi has been discussed above, and teaches a polycarbonate which comprises chemical isomers of formula (I) of Applicant wherein R^7 and R^8 are hydrogen, m is 4 and q is 4, wherein the polycarbonate substrate is disposed in a liquid crystal display device, but fails to teach that the polycarbonate substrate further comprises at least one substantially transparent conductive layer comprising an oxide of indium oxide doped with tin.

Imazeki teaches that a typical liquid crystal display (column 1, lines 35-40) has a pair of transparent polymeric (plastic) substrates 7a and 7b substantially parallel to each other as seen in Fig. 5 below, transparent conductive layers (electrodes) 8a and 8b made of indium tin oxide, which is indium oxide doped with tin, disposed on a surface of each of said polymeric substrates, and a liquid crystal material 10 which contacts the transparent conductive layers (electrodes) 8a and 8b (column 3, lines 10-20).

Fig. 5



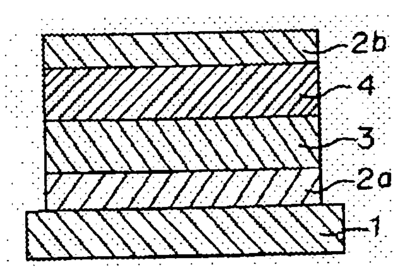
The substrates 7a and 7b are polycarbonate bases laminated with barrier layers which may be organic or inorganic (column 3, lines 25-35). The substrates 7a and 7b are planar (see Fig 5 above) and thus have a uniform thickness that varies less than 3%.

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made, to have disposed on the polycarbonate substrate of Ito in view of Mitsubishi, at least one transparent conductive layer comprising an indium tin oxide made of indium oxide and tin dopant, as taught by Imazeki, in order to provide electrical conduction for driving the display medium.

5. Claims 24-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ito in view of Mitsubishi Chem Corp as applied to claims 15-21 above, and further in view of Tashiro (US 5,059,863).

Ito in view of Mitsubishi has been discussed above, and teaches a method of using a polycarbonate substrate in which the polycarbonate comprises chemical isomers of formula (I) of Applicant wherein R^7 and R^8 are hydrogen, m is 4 and q is 4, wherein the polycarbonate substrate is disposed in an electroluminescent device, but fails to teach that the polycarbonate substrate further comprises at least one substantially transparent conductive layer comprising an oxide of indium oxide doped with tin.

Tashiro has an organic electroluminescent device which comprises a polymeric substrate made of a transparent polycarbonate (column 2, lines 40-50). Tashiro in Fig. 1 on the next page discloses that the layers of the laminate are planar. Thus the polymer substrate 1 has a uniform thickness that varies less than about 3%.



The polymeric substrate 1 comprises organic electroluminescent material layer 4 (column 4, lines 5-10) disposed between two electrodes (conductive layers 2a and 2b) (column 3, lines 20-25). Anode electrode 2a (column 3, lines 5-10) when transparent (column 2, lines 65-70) is indium tin oxide (column 27, lines 60-65) wherein the indium

oxide contains the tin dopant. Cathode electrode 2b comprises Sn (tin), Mg (magnesium), In (indium), Al (aluminum), Ag (silver) and alloys thereof (column 3, lines 10-20).

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made, to have disposed on the polycarbonate substrate of Ito in view of Mitsubishi, at least one transparent conductive layer comprising an indium tin oxide made of indium oxide and tin dopant, and other alloys containing magnesium, aluminum as taught by Tashiro, in order to provide electrodes for driving the display medium, with the desired balance of transparency and conductivity.

6. Claims 24-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ito in view of Mitsubishi Chem Corp as applied to claims 15-21 above, and further in view of Uchitsugu et al. (JPO Website Machine English Translation of JP 09-259640).

Ito in view of Mitsubishi has been discussed above, and teaches a method of using a polycarbonate substrate in which the polycarbonate comprises chemical isomers of formula (I) of Applicant wherein R^7 and R^8 are hydrogen, m is 4 and q is 4, wherein the polycarbonate substrate is disposed in an electroluminescent device, but fails to teach that the polycarbonate substrate further comprises at least one substantially transparent conductive layer comprising an oxide of at least one metal selected from the group consisting of tin, indium, zinc, gallium, and combinations thereof, and a dopant selected from gallium, germanium and tin.

Uchitsugu teaches a transparent conductive film formed on a plastic substrate (abstract), comprising an oxide of a metal selected from the group consisting of tin,

indium, zinc [0002], gallium [0004], and a dopant selected from gallium [00012], tin and germanium [0009]. Cadmium is right below zinc in the same group of the Periodic Table, and is therefore expected to have similar properties. Aluminum is right above gallium in the same group of the Periodic Table, and is therefore expected to have similar properties. Uchitsugu teaches that these transparent conductive films are used as transparent electrodes for displays, wherein the different metals are combined to provide the desired transparency and electrical conductivity.

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made, to have disposed on the polycarbonate substrate of Ito in view of Mitsubishi, a transparent conductive layer comprising an oxide of at least one metal selected from the group consisting of tin, cadmium, indium, zinc, gallium, and combinations thereof, and a dopant selected from the group consisting of gallium, aluminum, germanium and tin, in order to provide electrodes for driving the display, with the desired balance of transparency and conductivity.

Any inquiry concerning this communication should be directed to Sow-Fun Hon whose telephone number is (571)272-1492. The examiner can normally be reached Monday to Friday from 10:00 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Harold Pyon, can be reached at (571)272-1498. The fax phone number for the organization where this application or proceeding is assigned is (703)872-9306.

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S. Hon
Sow-Fun Hon
06/15/05

HAROLD PYON
SUPERVISORY PATENT EXAMINER
1772
6/20/05

FORM PTO-1449
(REV. 7-80)
(Title Amended 3/83)

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE

ATTY. DOCKET NO.	SERIAL NO.
122055	10/743,240 ~~10/134,050~~
Applicant	
Grant Hay et al.	
Filing Date	Group
04/29/02	1772

INFORMATION DISCLOSURE STATEMENT BY APPLICANT-- LIST OF ITEMS

(*Use several sheets if necessary*)

U.S. PATENT DOCUMENTS

*EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
SH	AA	6 2 2 2 0 0 3	04/24/02	Hosoi et al.	528	196	
	AB						
	AC						
	AD						
	AE						
	AF						
	AG						
	AH						
	AI						
	AJ						
	AK						

FOREIGN PATENT DOCUMENTS

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	AL							
	AM							
	AN							
	AO							
	AP							

OTHER INFORMATION (*Including Author, Title, Date, Pertinent pages. Etc.*)

SH	AR	"Criteria for Choosing Transparent Conductors" - Roy G. Gordon - MRS Bulletin, August 2000, pp. 52-57
SH	AS	"Intelligent Process Control of Indium Tin Oxide Sputter Deposition Using Optical Emission Spectroscopy", I.L. Eisgruber, J.R. Engel, R.E. Hollingsorth, P.K. Bhat-, R. Wendt - J. Vac. Sci. Technol. A 17(1), Jan./Feb. 1999, pp. 190197
SH	AT	"Influence of Apparatus Geometry and Deposition Conditions on the Structure and Topography of Thick Sputtered Coatings", John A. Thornton, J. Vac. Sci. Technol., Vol. 11, No. 4, July/Aug. 1974, pps. 666-670

EXAMINER	DATE CONSIDERED
Soo-Fu H[illegible]	06/15/05

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Notice of References Cited

Application/Control No.	Applicant(s)/Patent Under Reexamination	
10/743,240	HAY ET AL.	
Examiner	Art Unit	Page 1 of 1
Sow-Fun Hon	1772	

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-4,640,583	02-1987	Hoshikawa et al.	349/153
	B	US-5,059,863	10-1991	Tashiro et al.	313/504
	C	US-5,281,489	01-1994	Mori et al.	428/690
	D	US-5,414,069	05-1995	Cumming et al.	528/310
	E	US-5,817,383	10-1998	Takase et al.	428/1.54
	F	US-5,847,782	12-1998	Imazeki et al.	349/58
	G	US-6,270,863	08-2001	Daecher et al.	428/1.6
	H	US-6,476,179	11-2002	Ito et al.	528/196
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	Mitsubishi Chem Corp, Derwent Abstract 2002-409329 of JP 2002030165
	V	Toru et al., 10-1997, JPO Website Machine English translation of JP 09-272149
	W	Uchitsugu et al., JPO Website Machine English translation of Jp 09-259640.
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 09-259640

(43)Date of publication of application : 03.10.1997

(51)Int.Cl. H01B 5/14
C01G 15/00

(21)Application number : 08-095960

(22)Date of filing : 25.03.1996

(71)Applicant : MINAMI UCHITSUGU
TAKADA SHINZO

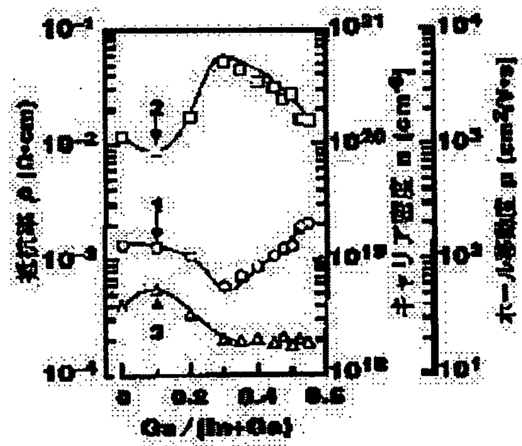
(72)Inventor : MINAMI UCHITSUGU
TAKADA SHINZO

(54) TRANSPARENT CONDUCTIVE FILM

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a transparent conductive film having higher conductivity than GaInO2 and In2O3, that is lower resistance, and an excellent optical property.

SOLUTION: An oxide film containing 15-40 atomic %, preferably 20-45 atomic %, of Ga content defined as Ga/(Ga+In) is formed on a glassy ceramic substrate or a plastic-like organic substrate as a substrate by, for example, a sputtering method using a mixed powder having a pseudo-binary composition of Ga2O3-In2O3 of which Ga content defined as Ga/(Ga+In) is within 15-49 atomic %, preferably 20-45 atomic % as a target, and if necessary the powder is fired or if necessary molded and sintered.



LEGAL STATUS

[Date of request for examination] 03.10.2002

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the sintered compact used in order to manufacture the transparence electric conduction film and it which are used in order to manufacture a transparence touch switch.
[0002]
[Description of the Prior Art] as the transparent electrode of various display units or a thin film solar cell, or the energy-saving structural aperture glass coating material excellent in the ultraviolet-rays cutoff and the infrared reflection property need immense in the future is expected to be -- light permeability -- high -- low -- the transparence electric conduction film which has a property [****] is indispensable. As transparence electric conduction film used present most widely Tin oxide SnO_2 system which a metallic-oxide thin film is main and has high chemical stability (what added F or antimony (Sb) is mainly used.) To a pan [indium oxide / tin addition / which has outstanding electric / optical property / indium oxide (In_2O_3) and / [it is called below In_2O_3-SnO_2- ITO]], recently It is completely satisfactory also in resource at the low cost which applicants developed, and the zinc-oxide (ZnO) system which has outstanding electric / optical property which is equal to ITO is known.
[0003]
[Problem(s) to be Solved by the Invention] It is impossible however, to be unable to respond to diversification of an application increasing recently by the conventional transparence electric conduction film. For example, for the application of a transparence touch switch, although low resistivity is not necessarily needed, uniform and high light transmittance and the transparence electric conduction film which has the optical refractive index of arbitration further are rather called for over the large area. Although offer of the transparence electric conduction film which can control the chemical resistance over an acid, alkali, etc. freely is demanded without furthermore reducing the membranous engine performance, it is impossible to already correspond by the conventional transparence electric conduction film.
[0004]
[Means for Solving the Problem] The transparence electric conduction film characterized by for the amount of Ga(s) shown by Ga/(Ga+In) in a system forming 15 to 49 atom % and the oxide film made desirable 20-45 atom % content, and changing is offered. [of the pseudo-2 yuan shown by Ga_2O_3-In_2O_3] The amount of Ga(s) cannot demonstrate the description of this invention at 15% or less. Moreover, $GaInO_3$ known conventionally is

included in 49.1% or more of range. In $GaInO_3$ known conventionally, the presentation region which becomes this invention includes considerably different presentation range, and can predict it neither from $GaInO_3$ presentation nor a property. The transparence electric conduction film which has conductive, i.e., are lower, resistivity higher than $GaInO_3$ and In $2O_3$ and the outstanding optical property by this invention can be offered. Furthermore by this invention, it aims at offering the target material used in order to manufacture the new transparence electric conduction film which can solve said trouble by the stability in the inside of elevated-temperature oxidizing quality **** and moderate chemical resistance being realizable, and this film.
[0005] In the pseudo-2 yuan system presentation which becomes Ga_2O_3-In_2O_3, the amount of Ga(s) specifically shown by Ga/(Ga+In) 15-49, the mixed powder of the presentation which is in the range of 20 - 45 atom % preferably, Molding and the sintered thing are used for a target baking or if needed if needed. Or by for example, the spatter When the amount of Ga(s) shown by Ga/(Ga+In) forms 15 to 49 atom %, and the oxide film made desirable 20-45 atom % content on a nature substrate of a ceramic like glass as a base, or an organic substrate like plastics, the object of this invention can be attained.
[0006] not only the approach described above as a manufacturing method of this transparence electric conduction film that becomes this invention but a vacuum deposition method, and chemistry gaseous-phase crystal growth (CVD) -- the thin film producing methods of well-known arbitration, such as law, a sol-gel method, and molecular beam epitaxy, can be used.
[0007]
[work --] for In case it forms by the well-known thin film producing method for having mentioned above the thin film of above-mentioned presentation within the limits which suits the object of this invention on this base, generation of the carrier by an exogenous donor's installation which some of endogenous donors by intrinsic lattice defects, such as an oxygen hole and an interstitial atom, and III group elements permute by IV group element, and some of permutations and VI group elements permute by the VII group element is possible. The thin film which becomes this invention has attained the low resistivity which is an amorphous substance or $GaInO_3$, $GaInO_3$ and In_2O_3, $GaInO_3$, and the quality of a microcrystal that consists of the mixed phase of Ga_2O_3 grade, and enables high carrier generation by the above-mentioned mechanism, consequently is looked at by neither $GaInO_3$ nor In $2O_3$. In addition, the optical refractive index of this transparence electric conduction film has the description that it is changeable from about 1.8 to 2.1 of the conventional transparence electric conduction film, by changing a presentation. [applicable to the nonreflective coating film which has high conductivity by using it combining this film, and the thin film of 2.0 or 2.0 or more optical refractive indexes or the transparence electric conduction film, an interference filter or a reflector (black reflector), the ornament coating film for apertures, etc. -- under a patent application --; Japanese-Patent-Application-No. 7-94555]. Although this film is impurity additive-free film, a high carrier consistency is obtained easily and it produces the operation effectiveness that this film that was moreover excellent in the optical property is realizable. Moreover, it has the description that moderate chemical resistance can be given, by changing a presentation. It can respond to the needs diversified as a result enough.
[0008]

[Example 1] After mixing each powder of Ga 2O3 and In2O3 to homogeneity with 33.0 or 67-mol % of a mole fraction, respectively, the baking powder calcinated at 1000 degrees C among the argon for 5 hours was put in the pan made from stainless steel with a diameter of 80mm, and it considered as the sputtering target. Pure argon gas was used for sputtering gas. Sputtering gas ** was set as 0.2Pa, and spatter membrane formation was performed by RF charge power 40W on the room temperature -350 degree C glass substrate held to the target side at parallel. Ga / (Ga+In) presentation dependency of the typical electrical characteristics in this 2OGa2O3-In3 thin film produced at the substrate temperature of 200 degrees C to drawing 1 are shown. As a result of x line diffraction analyzing the produced film, in the film which Ga produced in the range of 45 atoms % - 49 atom %, the GaInO three phase circuit was detectable. For the resistivity of the film which has the average thickness of this film in 420nm, and was obtained from the room temperature at the substrate temperature of 350 degrees C, the range of about 20 cm/V-sec and carrier concentration of 5.0x10-4ohmcm and mobility was 4-5x1020cm-3. Moreover, the average light permeability of the produced film was 80%. In addition, as a result of introducing oxygen at the time of a spatter and forming membranes at it, average light permeability rose to 85%. However, membranous resistivity became rather high when oxygen was put in too much. As a result of producing this film that furthermore pentatomic % Replaced Ga of Ga2O3-In 2O3 by Y, resistivity fell to 3.9x10-4ohmcm. Moreover, even when a substrate was held vertically and membranes were formed, the almost same result as the above was obtained. On the other hand, in the case where it produces at the substrate temperature of 350 degrees C, this permeability became 87%, without spoiling electrical characteristics.
[0009]
[Example 2] As a result of producing the film which did a maximum of 10 atoms % addition of Si, germanium, Sn, Pb, Ti, and Zr as an IV group element at the target used in the example 1, respectively, resistivity was able to be made low 20% or more, without average light permeability falling compared with any film addition-before. Moreover, the average light permeability of the produced IV group element addition this oxide film was 80% or more. Moreover, although this permeability became 85% when oxygen was added with the partial pressure at the time of film production, resistivity showed the inclination which becomes high. In addition, even when a substrate was held vertically and membranes were formed, the almost same result as the above was obtained. On the other hand, in the case where it produces at the substrate temperature of 350 degrees C, permeability has been improved to 85%, without spoiling electrical characteristics.
[0010]
[Example 3] Membranes were formed by introducing CF4 gas to a 1x10 to 2 Pa partial pressure in a sputtering system as a dopant containing a VII group element in addition to the same conditions as an example 1. The average thickness of the produced film is 380nm, and was able to make resistivity low 15% or more by the film produced at the room temperature. Moreover, the average light permeability of the produced fluoridation this oxide film was 80% or more. In addition, even when a substrate was held vertically and membranes were formed, the almost same result as the above was obtained. On the other hand, in the case where it produces at the substrate temperature of 350 degrees C, permeability has been improved to 85%, without spoiling electrical characteristics.
[0011]

[Example 4] In examples 1 and 2 or film production of 3, the sintered compact target which cast the dopant ingredient powder which is introduced as an additive in addition to 2OGa3 powder and 2OIn3 powder, or them in diameter of 80mm after mixing to addition and homogeneity in the range of 1-10 atom % and which carried out the afterbaking join was used. The almost same result as electric / optical property of the transparence electric conduction film which was produced using the baking powder target in the case of which was obtained. Moreover, it checked that the same result was realizable also by the direct-current magnetron sputtering method for having used the sintered compact target.
[0012]
[Example 5] With an atmospheric-pressure CVD method, as a Ga raw material, Ga acetyl aceto NETETO [Ga (acac)3], As an In raw material, using H2O as indium acetylacetonate [In (acac)3] and an oxygen raw material, the container made from stainless steel which had all the raw materials heated is filled up, and stainless steel piping is led. Material gas with carrier gas This transparence electric conduction film that supplies towards the glass substrate which is set in a quartz reactor and heated by 350 degrees C, and consists of this oxide film was produced on this glass substrate. In addition, the carrier gas flow rates of raw material temperature were 500CCM, 20CCM, and 2.6x10-3mol/min at 85 degrees C, 150 degrees C, 73 degrees C, and a list, respectively. 400nm in thickness, resistivity 2.6x10-3ohmcm, and the average light permeability of the produced film were 85% or more. Moreover, when x line diffraction analyzed this film, it was detected though the same GaInO3 as the case of the film obtained in the examples 1-4 was weak.
[0013] The transparence electric conduction film which becomes this invention can be used combining suitably various kinds of compounds, such as an organometallic complex like an oxide including an III group, the low-grade oxide which is easy to evaporate, acetate, or alcoholate, although it is not limited only to said example and the oxide was used for all raw materials in various raw materials, for example, said example. That is, many complex salt and complexes, such as an alkyl compound like a salt like a gallium chloride (GaCl3), an alkoxide like Ga(OC2H5) 3 or halo GENAIDO, an organometallic complex still like Ga(C2H5)2Cl and Dimethyl Ga [Ga (CH3)3], and Diethyl Ga [Ga (C2H5)3] as a Ga raw material, can be used. Moreover, it cannot be overemphasized that the compound group same also about In which is an III group element as the above can be used.
[Effect of the Invention] The 3.4eV as the conventional-type transparence electric conduction film with the band gap almost same [the transparence electric conduction film which becomes this invention], and an optical refractive index are about 1.8, and are the description with big a high carrier consistency being obtained easily. Consequently, high conductivity was easy to be acquired and, moreover, the effectiveness that there was very little absorption in a light field was acquired. Consequently, the effectiveness that the effectiveness that it can respond to the various needs to the transparence electric conduction film, and this transparence electric conduction film could realize moderate chemicals resistance was acquired.

[Translation done.]

CLAIMS

[Claim(s)]

[Claim 1] The conductive layered product characterized by having the non-oxide ceramics layer prepared through the direct or under coat layer on the predetermined side of a substrate, and the topcoat layer which consists of a transparent conductive oxide prepared on this non-oxide ceramics layer.

[Claim 2] The conductive layered product according to claim 1 which a non-oxide ceramics layer becomes from the boride ceramics, carbide ceramics, nitride ceramics, or the sulfide ceramics.

[Claim 3] The conductive layered product according to claim 1 or 2 which consists of one sort chosen from the group in which a non-oxide ceramics layer contains one sort or two or more sorts of metal particles which have conductivity and, which the aforementioned metal particles become from Au, Ag, Cu, Pt, and aluminum, or two or more sorts.

[Claim 4] a transparent conductive oxide -- In 2O3, ZnO, and SnO2 And Ga 2O3 from -- from one sort chosen from the becoming group, or two or more sorts -- becoming -- and the resistivity of this transparent conductive oxide layer -- 1x102 Conductive layered product given in any 1 term of claim 1 - claim 3 which are below omega-cm.

[Claim 5] A conductive layered product given in any 1 term of claim 1 - claim 4 which an under coat layer becomes from a transparence metallic oxide and/or transparence resin.

[Claim 6] The conductive transparence substrate characterized by having a transparence substrate, the non-oxide ceramics layer prepared through the direct or under coat layer on the predetermined side of this transparence substrate, and the topcoat layer which consists of a transparent conductive oxide prepared on this non-oxide ceramics layer.

[Claim 7] The conductive transparence substrate according to claim 6 with which a non-oxide ceramics layer consists of the boride ceramics, carbide ceramics, nitride ceramics, or sulfide ceramics.

[Claim 8] The conductive transparence substrate according to claim 6 or 7 which consists of one sort chosen from the group in which a non-oxide ceramics layer contains one sort or two or more sorts of metal particles which have conductivity and, which the aforementioned metal particles become from Au, Ag, Cu, Pt, and aluminum, or two or more sorts.

[Claim 9] a transparent conductive oxide -- In 2O3, ZnO, and SnO2 And Ga 2O3 from -- from one sort chosen from the becoming group, or two or more sorts -- becoming -- and the resistivity of this transparent conductive oxide layer -- 1x102 Conductive transparence substrate given in any 1 term of claim 6 - claim 8 which are below omega-cm.

[Claim 10] A conductive transparence substrate given in any 1 term of claim 6 - claim 9 which an under coat layer becomes from a transparence metallic oxide and/or transparence resin.

[Translation done.]

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(71)Applicant : KANEGAFUCHI CHEM IND CO LTD

(72)Inventor : UEDA TORU
MATSUMOTO KENJI
HOSOKAWA YOICHI

(54) MANUFACTURE OF THERMOPLASTIC RESIN BOARD FOR LIQUID CRYSTAL DISPLAYING ELEMENT

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a lightweight thermoplastic resin board excellent in impact resistance by a method wherein a thermoplastic resin sheet is heated up to a temperature higher than the glass transition temperature of thermoplastic resin and then, under the condition being brought into contact with a base material having a smooth surface under pressure, cooled down to a temperature lower than the glass transition temperature by the specified value in °C.

SOLUTION: A thermoplastic resin sheet is heated up to a temperature higher than the Tg of thermoplastic resin. The heated thermoplastic resin sheet is cooled down to a temperature lower than the Tg of the thermoplastic resin by 20°C under the state being brought into contact with a base material having a smooth surface under pressure. After the pressure is released and the base material having the smooth surface is removed from the cooled thermoplastic resin sheet, a thermoplastic resin board for liquid crystal displaying element can be obtained. As a result, the resultant board is lightweight and excellent in impact resistance and its retardation value is small and has an extremely smooth surface having almost neither undulation nor warp.

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* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the process of the thermoplastics substrate for liquid crystal display components. It is related with the approach that it is lightweight, a retardation value is small in more detail in excelling in shock resistance, and it has the very smooth front face which almost has neither a wave nor camber, for example, a glass substrate and the thermoplastics substrate for liquid crystal display components for which it can be substituted can be easily manufactured in the field of a liquid crystal display.
[0002]
[Description of the Prior Art] In recent years, the liquid crystal display component which employed the description of a light weight and a compact efficiently is increasingly used abundantly so that electronic equipment may be miniaturized increasingly, for example, it may be represented with a notebook sized personal computer, a word processor, a Personal Digital Assistant, etc. This liquid crystal display component has the structure which generally sandwiched the both sides of a liquid crystal layer with the substrate which has a transparence conductive layer.
[0003] As said substrate, since it excels in optical transparency, the optical isotropy, and thermal resistance, the glass substrate is used widely. However, in being inferior to shock resistance, since this glass substrate has large specific gravity, it has the fault that the weight of a device increase-izes. Although the thin glass substrate whose thickness is usually about 0.4mm is used in order to attain lightweight-ization when including a liquid crystal display component in a pocket device especially, for the brittleness of glass, a crack arises in the assembly process of a liquid crystal display component, the yield falls or it poses a big problem that breakage of glass often takes place at the time of use of a pocket device.
[0004] Thus, toughening and lightweight-izing of the substrate of a liquid crystal display component are desired especially strongly in recent years. Then, use of the plastic plate which using a plastic plate as this substrate is proposed from the point of it being lightweight and excelling in shock resistance, for example, has the thickness which is about 0.4mm is tried.
[0005] Generally, thermal resistance is high and there are the solvent casting method, a melting extrusion method, etc. as an approach front-face nature obtains a good plastic plate. However, if a film is thick-film-ized so that rigidity may be given to the substrate obtained when said solvent casting method is adopted, since it is easy to produce defects, such as foaming, and also productivity will fall sharply and it will become difficult to industrial carry it out, it is a limitation to thick-film-ize even in thickness of about 200 micrometers. On the other hand, when said melting extrusion method is adopted, if a film is thick-film-ized, the optical isotropy will be spoiled, and also front-face nature and an appearance will fall by the die line at the time of extrusion molding. Therefore, it is difficult to use this conventional plastic plate as a substrate of a liquid crystal display component as it is.
[0006] Furthermore, in using a plastic plate as a substrate for liquid crystal display components, it becomes said thermal resistance and the problem other than rigidity that retardation, i.e., an optical anisotropy, and surface smooth nature are big.
[0007] In order for the fall of contrast to take place and for the quality as a liquid crystal display component to be inferior when an ingredient with this large retardation value is used as a substrate for liquid crystal display components although a plastic plate essentially has retardation, an ingredient with a retardation value small in the ability to do must be used for it.
[0008] On the other hand, there are three, "surface roughness", a "wave", and "camber", in the smooth nature of the front face made into a problem with the substrate for liquid crystal display components.
[0009] The above "surface roughness" is micro irregularity influenced by the property of the film rather formed on the surface of the substrate, the orientation of liquid crystal, the piece of a pattern edge, etc. from it being the thing of the surface roughness specified by JIS-B0601, being the irregularity which usually appears repeatedly over many times in 1-2mm or less, and generally being a change finer than the resolution of people's eyes.

[0010] On the other hand, the above "a wave" is the irregularity of the front face whose period is 1mm or more, and it has the period which is usually about 5-20mm, and has possibility of causing periodic unevenness in the background color of a display etc.

[0011] Moreover, the above "camber" is irregularity of a long period which usually appears one to about twice in a substrate. Therefore, in case this wave and camber carry out vacuum adsorption of the substrate in the production process of a liquid crystal display component, and on the activity board, it is required that it should be controlled by extent which does not make extent which un-arranging does not produce, the background of the whole display, etc. generate big nonuniformity.

[0012] Here, the color of the background of said whole display changes with the products (deltanxd) of the anisotropy (deltan) of the refractive index of liquid crystal and the thickness (d) of a liquid crystal layer which are enclosed between substrates. The liquid crystal display panel assembled when said liquid crystal was for example, the Twisted Nematic (TN) liquid crystal at this time is colorless, and since it will be success as a panel if a shade is clear, is clear and there is, though some waves and camber exist in the front face of a substrate in which the transparent electrode is formed, the quality as a liquid crystal display component is hardly affected.

[0013] However, the standup property over the electric field is very steep, even if it makes the number of scanning lines increase, contrast does not fall but the super-twisted-nematic (STN) liquid crystal with which said TN liquid crystal was improved is becoming the mainstream in a passive matrix from the point that the display engine performance of the liquid crystal display component obtained can be raised in recent years.

[0014] However, when a wave and camber exist in the front face of a substrate in which the transparent electrode is formed in order to twist at about 270 degrees in spite of usually enclosing the spacing between the substrates which are about 5-6 micrometers, it colors black and purple and the problem that a screen stops being able to be visible very easily produce [a display] said STN LCD.

[0015] Then, since the difficulty of being visible of a screen cannot fully be reduced only by raising the assembly technique of a liquid crystal display component, such as making thickness of this liquid crystal layer into homogeneity too, although to reduce the difficulty of being visible of a screen by making thickness of the STN LCD layer to enclose into homogeneity more is also tried among these contractors It is thought required to make it whether a wave and camber are made on on the surface of a substrate and not exist.

[0016] Thus, conventionally, a retardation value is small to extent which can be suitably used as a substrate for liquid crystal display components, and the actual condition is that the plastic plate with which a wave and camber hardly exist is not obtained, and it waits eagerly for development of the approach that the substrate which has this property can be manufactured easily.

[0017]

[Problem(s) to be Solved by the Invention] This invention aims at offering the approach that the thermoplastics substrate which has the very smooth front face which it is lightweight, is made in view of said conventional technique, whose retardation value is small in excelling in shock resistance, and almost has neither a wave nor camber can be manufactured easily.

[0018]

[Means for Solving the Problem] This invention relates to the process of the thermoplastics substrate for liquid crystal display components characterized by heating a transparent thermoplastics sheet to the temperature more than the glass transition temperature of this thermoplastics, making the base material which has a smooth side contact optically, and cooling under pressurization to the temperature below temperature lower 20 degrees C than this glass transition temperature.

[0019]

[Embodiment of the Invention] The process of the thermoplastics substrate for liquid crystal display components of this invention is characterized by heating a transparent thermoplastics sheet to the temperature more than the glass transition temperature (henceforth Tg) of this thermoplastics, making the base material which has a smooth side contact optically, and cooling under pressurization to the temperature below this temperature lower 20 degrees C than Tg, as described above.

[0020] In this specification, transparence means optically that the light transmission (wavelength of 550nm) measured using the recording spectrophotometer (Shimadzu Make, UV-3100) is 80% or more, and Hayes (haze) measured using the hazemeter (the Nippondenso Co., Ltd. make, NDH-300A) is 5% or less.

[0021] According to the approach specified to JIS-B0610, a wave is the value WCA (wave filtration center line wave) measured using the surface roughness meter (Tokyo Seimitsu Make and surfboard COM 1500A), and shows that fh is 0.8mm and fl is 8mm.

[0022] Camber shows the value Rmax (maximum height) which was specified to JIS-B0610 and measured using the surface roughness meter (Tokyo Seimitsu Make and surfboard COM 1500A) according to the approach.

[0023] Furthermore, a retardation value shows the thing of the value measured using the automatic birefringence meter

(the product made from KS Systems, KOBRA-21SDH).
[0024] In the process of this invention, a transparent thermoplastics sheet is first heated to the temperature more than Tg of this thermoplastics optically.
[0025] The Tg can use especially preferably 140 degrees C or more of 100 degrees C or more of sheets of the thermoplastics which is 180 degrees C or more preferably suitably still more preferably, for example from the point of having the thermal resistance higher enough than the heat-resistant temperature demanded in the manufacture process of a liquid crystal display component as a thermoplastics sheet used for this invention.
[0026] As said thermoplastics, polysulfone system resin, such as polyester system resin, such as polyarylate (Tg:215 degree C) and a polycarbonate (Tg:150-206 degree C), polysulfone (Tg:190 degree C), and polyether sulphone (Tg:230 degree C), etc. is raised, for example.
[0027] Said thermoplastics may be independent, or can be used combining two or more sorts, and may be any of a blend, an alloy, and copolymerization as a gestalt of this combination.
[0028] Moreover, if the moldability at the time of dealing in a transparent sheet optically from this thermoplastics in said thermoplastics and industrial availability are taken into consideration The amorphous polyarylate which has an aromatic series radical in a principal chain, and especially an amorphous polycarbonate are desirable. Specifically The hydroxy propane which may be permuted, the hydroxy phenylmethane which may be permuted, The polymer obtained using the hydroxy cycloalkane which may be permuted as a polymerization component, the polymer blend which will become from now on, a polymer alloy, etc. are used preferably.
[0029] In addition, said polyarylate shows the polymer obtained from aromatic series dicarboxylic acid and the phenols of bivalence, and a polycarbonate shows the polymer which consists of a carbonate of the phenols of bivalence.
[0030] Moreover, it is possible to use polymers which the aromatic polyester system copolymer (JP,57-73021,A) and the phenol excellent in thermal resistance, and ketone compound which the alkali-metal salt and terephthalic-acid chloride of two or more sorts of specific bisphenols were made to react using phase transfer catalysis as thermoplastics illustrated like the above, and were obtained, for example were made to react, and were obtained, such as a thermoplastic polycarbonate (JP,2-88634,A) which is excellent in thermal resistance and has the amount of giant molecules.
[0031] Although the approach of making said thermoplastics fabricating with the approach of making it forming for example, by the solvent casting method used for this invention and a melting extrusion method etc. is employable in order to manufacture a transparent thermoplastics sheet optically, it is desirable to adopt the approach of making thermoplastics fabricating with a melting extrusion method, from the point that excel in productivity and cost is reduced.
[0032] 0.2mm or more, as for the thickness of a transparent thermoplastics sheet, it is desirable that it is 0.4mm or more preferably, and it is optically desirable in the point that there is no possibility that rigidity sufficient as a substrate for liquid crystal display components may be given, and the use in the manufacture process of a liquid crystal display component may become difficult, from the point of lightweight-izing of the thermoplastics substrate for liquid crystal display components that it is 0.7mm or less preferably 1mm or less.
[0033] Next, a thermoplastics sheet is heated to the temperature more than Tg of this thermoplastics.
[0034] Although the heating temperature at the time of heating should just be the temperature more than Tg of thermoplastics as described above, it is desirable that they are temperature higher 10 degrees C or more than the point that the retardation value of the thermoplastics substrate obtained for a short time can be made small to Tg, and desirable temperature higher, 20 degrees C or more than Tg. Moreover, when the point of the denaturation of thermoplastics and the discoloration accompanying it is taken into consideration, as for this heating temperature, it is desirable that it is below temperature higher 50 degrees C than Tg.
[0035] In addition, in this invention, heating of a thermoplastics sheet may contact beforehand this thermoplastics sheet and the base material which has the smooth side mentioned later, and may be performed under pressurization.
[0036] Moreover, what is necessary is just the time amount which there is no limitation especially in heating time, and a thermoplastics sheet softens moderately.
[0037] Next, the thermoplastics sheet heated like the above is contacted to the base material which has a smooth side, and it cools under pressurization to the temperature below temperature lower 20 degrees C than Tg of thermoplastics.
[0038] In order to make it a wave and camber hardly exist in the front face of the thermoplastics substrate obtained as a base material which has said smooth side, it is desirable for 0.1 micrometers or less of waves of the smooth side to be a thing 0.05 micrometers or less preferably, and it is desirable for 200 micrometers or less of camber to be a thing 170 micrometers or less preferably. As this base material, synthetic-resin plates, such as a glass plate, a metal plate, for example, the polycarbonate plate obtained by injection molding, and an acrylic board with which surface polish was given, etc. are raised, for example. In these, the point that a wave is very small to the glass plate and metal plate of the smooth side are desirable, and the surface polish glass plate for liquid crystal substrates, the press plate made from surface polish stainless steel (SUS), etc. are especially desirable.

[0039] Moreover, the base material which performed surface treatment in order to raise detachability with a thermoplastics sheet may be used.
[0040] In order to fully abolish the wave and camber which exist in the front face of a thermoplastics sheet, as for the welding pressure at the time of contacting a thermoplastics sheet to the base material which has a smooth side, and pressurizing it, it is desirable that it is 1kg/cm2 or more preferably 0.5kg/cm2 or more. Moreover, when it takes into consideration that the thickness of a thermoplastics sheet decreasing extremely and softened thermoplastics overflow the base material which has the smooth side used in case it pressurizes, as for this welding pressure, it is desirable that it is 10kg/cm2 or less.
[0041] Although there is no limitation especially in the approach of said pressurization, the continuous system using double belting press equipment etc., the batch type for example, using press equipment etc., etc. are employable, for example.
[0042] Although the temperature at the time of cooling a thermoplastics sheet under pressurization is below temperature lower 20 degrees C than Tg of thermoplastics, it is desirable that it is below temperature lower 40 degrees C than the point of more fully stiffening the softened thermoplastics sheet to Tg. In addition, what is necessary is to make cooling of this thermoplastics sheet cool radiationally to a room temperature, and just to perform it for example, under pressurization.
[0043] Next, a pressure can be made to be able to open wide from the thermoplastics sheet after cooling, and it can deal in the thermoplastics substrate for liquid crystal display components by removing the base material which has a smooth side.
[0044] The thermoplastics substrate for liquid crystal display components obtained by the process of this invention is lightweight, in excelling in shock resistance, its retardation value is small, and it has the very smooth front face which almost has neither a wave nor camber. Therefore, this thermoplastics substrate for liquid crystal display components Can use suitably as a substrate for liquid crystal display components with which the glass substrate was used conventionally, and also For example, by making the transparence conductive layer for constituting a pen input device form in one front face of this thermoplastics substrate, and making a gas barrier layer and the transparence conductive layer for a liquid crystal display drive form in the front face of another side serially It can also be suitably used as a substrate for liquid crystal displays with which the pen input unit was unified.
[0045]
[Example] Next, although the process of the thermoplastics substrate for liquid crystal display components of this invention is further explained to a detail based on an example, this invention is not limited only to this example.
[0046] It is a melting extrusion method about the amorphous polycarbonate (Tg:150 degree C) which uses example 1 bisphenol A as a polymerization component, it was made to carry out a polymerization, and was obtained. The polycarbonate sheet (light transmission: 92%, Hayes:0.3%, thickness:0.4mm) made to fabricate was put with the surface polish glass plate for two liquid crystal substrates (the wave of a smooth side: 0.02 micrometers, camber:150micrometer of a smooth side, the Asahi Glass Co., Ltd. make, indium tin multiple oxide (ITO) film coating glass), and 185 degrees C was made it to carry out heating sticking by pressure for 20 minutes under 1kg/cm2 pressurization using a pressurizer.
[0047] Where the next is pressurized, after cooling a polycarbonate sheet radiationally to a room temperature (20 degrees C), the pressure was made to open wide, the glass plate was removed, and the polycarbonate substrate with a thickness of 0.4mm was obtained.
[0048] The wave, the surface camber, and surface retardation value of the obtained polycarbonate substrate were investigated according to the following approaches. The result is shown in Table 1.
[0049] (b) The wave (WCA (micrometer)) of the front face of a polycarbonate substrate was measured using the external waviness surface roughness meter (Tokyo Seimitsu Make and surfboard COM 1500A).
[0050] (b) The camber (Rmax (micrometer)) of the front face of a polycarbonate substrate was measured using the camber surface roughness meter (Tokyo Seimitsu Make and surfboard COM 1500A).
[0051] (c) The retardation value (nm) of a polycarbonate substrate was measured using the retardation value automatic birefringence meter (the product made from KS Systems, KOBRA-21SDH).
[0052] It is a melting extrusion method about the amorphous polycarbonate (Tg:150 degree C) which uses example 2 bisphenol A as a polymerization component, it was made to carry out a polymerization, and was obtained. The polycarbonate sheet (light transmission: 92%, Hayes:0.3%, thickness:0.4mm) made to fabricate was put with the surface polish glass plate for two liquid crystal substrates (the wave of a smooth side: 0.02 micrometers, camber:150micrometer of a smooth side, the Asahi Glass Co., Ltd. make, indium tin multiple oxide (ITO) film coating glass), and 185 degrees C was made it to carry out heating sticking by pressure for 20 minutes under 3kg/cm2 pressurization using a pressurizer.
[0053] Where the next is pressurized, after cooling a polycarbonate sheet radiationally to a room temperature (20 degrees C), the pressure was made to open wide, the glass plate was removed, and the polycarbonate substrate with a

thickness of 0.4mm was obtained.
[0054] The wave, the surface camber, and surface retardation value of the obtained polycarbonate substrate were investigated like the example 1. The result is shown in Table 1.
[0055] It is a melting extrusion method about the amorphous polycarbonate (Tg:150 degree C) which uses example 3 bisphenol A as a polymerization component, it was made to carry out a polymerization, and was obtained. The polycarbonate sheet (light transmission: 92%, Hayes:0.3%, thickness:0.4mm) made to fabricate was put with the surface polish glass plate for two liquid crystal substrates (the wave of a smooth side: 0.02 micrometers, camber:150micrometer of a smooth side, the Asahi Glass Co., Ltd. make, indium tin multiple oxide (ITO) film coating glass), and 200 degrees C was made it to carry out heating sticking by pressure for 20 minutes under 1kg/cm2 pressurization using a pressurizer.
[0056] Where the next is pressurized, after cooling a polycarbonate sheet radiationally to a room temperature (20 degrees C), the pressure was made to open wide, the glass plate was removed, and the polycarbonate substrate with a thickness of 0.4mm was obtained.
[0057] The wave, the surface camber, and surface retardation value of the obtained polycarbonate substrate were investigated like the example 1. The result is shown in Table 1.
[0058] An example 41, 1-screw (4-hydroxyphenyl) - Let a 3, 3, and 5-trimethyl cyclohexane and bisphenol A be polymerization components. the amorphous polycarbonate (Tg:206 degree C and the Bayer make --) which was made to carry out a polymerization and was obtained High thermal-resistance polycarbonate sheet which made Apec KUI-9371 (trademark) fabricate with a melting extrusion method HT (light transmission: 93%) Hayes: It is a surface polish glass plate for two liquid crystal substrates (the wave of a smooth side: 0.02 micrometers) about 0.3% and thickness:0.4mm. Camber of a smooth side: It put with 150 micrometers, the Asahi Glass Co., Ltd. make, and indium tin multiple oxide (ITO) film coating glass, and 230 degrees C was made to carry out heating sticking by pressure for 20 minutes under 1kg/cm2 pressurization using a pressurizer.
[0059] Where the next is pressurized, after cooling a high thermal-resistance polycarbonate sheet radiationally to a room temperature (20 degrees C), the pressure was made to open wide, the glass plate was removed, and the polycarbonate substrate with a thickness of 0.4mm was obtained.
[0060] The wave, the surface camber, and surface retardation value of the obtained polycarbonate substrate were investigated like the example 1. The result is shown in Table 1.
[0061] About the polycarbonate sheet (substrate) (light transmission: 92%, Hayes:0.3%, thickness:0.4mm) which made the amorphous polycarbonate (Tg:150 degree C) which uses example of comparison 1 bisphenol A as a polymerization component, it was made to carry out a polymerization, and was obtained fabricate with a melting extrusion method, the wave, camber, and retardation value of the front face were investigated like the example 1. The result is shown in Table 1.
[0062] The example 21 of a comparison, 1-screw (4-hydroxyphenyl) - Let a 3, 3, and 5-trimethyl cyclohexane and bisphenol A be polymerization components. About the high thermal-resistance polycarbonate sheet (substrate) (light transmission: 93%, Hayes:0.3%, thickness:0.4mm) which made the amorphous polycarbonate (Tg:206 degree C, the Bayer make, Apec HT KUI-9371 (trademark)) which was made to carry out a polymerization and was obtained fabricate with a melting extrusion method, the wave, camber, and retardation value of the front face were investigated like the example 1. The result is shown in Table 1.
[0063]
[Table 1]

表 1

実施例番号	ポリカーボネート基板の特性		
	うねり (μm)	そり (μm)	リターデーション値 (nm)
1	0.10	170	2
2	0.07	150	2
3	0.04	180	0
4	0.10	170	3
比較例 1	0.36	220	150
2	0.40	240	120

[0064] The polycarbonate substrate obtained in the examples 1-4 surges compared with the polycarbonate sheet

(substrate) to which melting extrusion molding of the polycarbonate was carried out like the examples 1-2 of a comparison, and the result shown in Table 1 shows that camber and a retardation value are very small.

[0065]

[Effect of the Invention] According to the process of this invention, it is lightweight, in excelling in shock resistance, a retardation value is small, and the thermoplastics substrate for liquid crystal display components which has the very smooth front face which almost has neither a wave nor camber can be manufactured easily.

[0066] Moreover, since the thermoplastics substrate obtained by the process of this invention has an outstanding property which was described above, it is very useful as an optical substrate which replaces a glass substrate, for example in the field of a liquid crystal display.

[Translation done.]

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(71)Applicant : MITSUBISHI CHEMICALS CORP

(72)Inventor : HAYAKAWA SEIICHIRO
EZAKI SATOSHI
SUZUKI MIKIO
SAKAI AKIHIKO

(54) PLASTIC SUBSTRATE HAVING DIMENSIONAL STABILITY

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a plastic sheet which is dimensionally stable and is suitable especially for a liquid crystal display panel.

SOLUTION: When this plastic sheet is subjected to a heat cycle test wherein a test comprising heating a plastic sheet in air at 150°C for 3 h and leaving the sheet standing in air at 23°C at a relative humidity of 50% for 1 week is repeated three times, the dimensional change from before to after each test is ±0.02% lower.

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TITLE: Plastic board for liquid crystalline display panel has good dimensional stability on specific heat-cycling test and hot-water cycling test

PATENT-ASSIGNEE: MITSUBISHI CHEM CORP[MITU]

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BASIC-ABSTRACT:

NOVELTY - A plastic sheet has dimensional change of within plus or minus 0.02 % between each before and after three heat-cycling tests in which the plastic sheet is heated at 150 deg. C for 3 hours in the air and left at 23 deg. C at 50 % RH in the air for 1 week.

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for: a plastic sheet which has a dimensional change of within plus or minus 0.02 % between each before and after three hot water cycling tests in which the plastic sheet is dipped in a water held at 40 deg. C for 1 hour and left at 23 deg. C at 50 % RH in the air for 1 week; and a plastic sheet which is produced by photo-polymerizing and by curing a polymerizing composition with active energy rays in the presence of a radically polymerizing initiator.

USE - The plastic sheet is useful for plastic laminates having gas-barrier layer, a cured film and/or a conductive film. The plastic sheet is useful for an organic electric luminescent display panel, a touch panel, an optical disc, a panel for solar battery, low double refractive optical components, especially liquid crystal display panel.

ADVANTAGE - The plastic sheet has good dimensional stability